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The Abnormally High Pressure of February, 1932

The last week of January was marked by extraordinarily high barometer readings over the British Isles,* and high readings have continued almost without intermission throughout the whole of February. The month opened with an anticyclone centred over Ireland, where the readings exceeded 1044 mb. on the 1st. This persisted until the 4th, decreasing gradually in intensity; on the 5th it moved to Scandinavia, and on the 6th and 7th the centre lay over central Europe. On the 8th, however, a very sudden change occurred; the anticyclone moved rapidly north-eastward, while a depression between Ireland and Spitzbergen moved over Europe. Between the 9th and the 14th a very intense anticyclone moved slowly from Scandinavia to a position west of Ireland, whence it again passed over the British Isles, giving pressures above 1040 mb. every day until the 22nd. On the 18th and 19th the British centre formed part of a long ridge extending eastwards across Europe, giving easterly winds and very cold weather, but on the 20th this connexion was broken, and with northerly winds the temperature rose somewhat. During the remainder of the month the British anticyclone moved slowly northward to a position between Iceland and southern Scandinavia; on the 28th it again united with a ridge

*See *Meteorological Magazine*, February, 1932, p. 18.

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of high pressure extending into Russia, and there followed a period of strong easterly winds, dry and bitterly cold.

Taking the month as a whole, the centre of the anticyclone lay over northern Ireland, the average pressure at Malin Head being as high as 1035·4 mb., or 25·7 mb. above normal. So well developed an anticyclone would be noteworthy if it persisted for only a few days; as the average distribution for a month it is unique. At Stornoway the mean pressure was slightly lower, 1034·8 mb., but this was 27·0 mb. above normal,

Fig. 1.

probably the greatest deviation of pressure from normal in this region since the beginning of the *Daily Weather Report*. At Thorshavn the mean for the month was 1031·7 mb., while during the famous cold month of February, 1895 (the previous highest February mean on record there), the figure was only 1025·8 mb. The fortunate result that the temperature in February, 1932, was much higher than that in 1895 (at Kew the mean this year was 38·4° F. compared with 29·1° F. in 1895) was due to the circumstance, noted above, that the anticyclone was mainly an

isolated phenomenon lying over the sea, and was only connected with the great winter reservoir of cold air in north-eastern Europe for two short periods.

The average distribution of pressure during the past month is shown in fig. 1, and the deviations from normal in fig. 2. The most striking point about fig. 1 is the complete reversal of the normal pressure gradient from the Azores to Scotland, giving easterly winds over a large area. The centre of the Icelandic depression was displaced far to the south-west, and lay

Fig. 2.

near Newfoundland, while a long trough of low pressure extended across the Atlantic towards the Azores. An interesting point in fig. 2 is the limitation of the area occupied by pressures above normal, which is completely surrounded by an area of deficit accentuated at three almost equi-distant points. It is probable that in spite of the intensity of the anticyclone, the compensation by the surrounding pressure deficits was practically complete within the relatively small part of the northern hemisphere shown in fig. 2.

The Drought in Scotland during January and February, 1932

By J. CRICHTON, M.A., B.Sc.

During the last half of January, throughout February and in the first week of March over the greater part of Scotland there

TABLE I

Period, January—February, 1932

County	Greatest period in days of		Rainfall reported in County		No. of stations in County used
	*Absolute drought	*Partial dought	Lowest	Highest	
			in.	in.	
Wigtown	35	44	·01	·07	5
Kirkcudbright	36	40	·00	·41	8
Dumfries	15	39	·06	·13	6
Roxburgh	17	44	·21	·36	4
Selkirk	—	36	·35	·35	1
Peebles	—	36	·32	·32	1
Berwick	22	44	·37	·67	3
Haddington	17	41	·24	·33	2
Midlothian	—	40	·18	·59	7
Linlithgow	—	40	·15	·15	1
Lanark	29	41	·00	·21	4
Ayr	27	41	·00	·14	9
Renfrew	29	41	·00	·03	3
Dumbarton	25	39	·03	·11	2
Stirling	22	45	·03	·07	7
Bute	18	41	·05	·22	2
Argyll	24	39	·03	·41	10
Clackmannan	19	41	·04	·04	1
Kinross	—	41	·06	·06	1
Fife	19	41	·07	·27	5
Perth	32	41	·00	·24	17
Angus	17	41	·10	·20	4
Kincardine	—	41	·14	·14	1
Aberdeen	—	41	·18	·98	8
Banff	—	—	·24	1·02	4
Moray	—	—	·56	·61	2
Nairn	—	—	·44	·57	2
Inverness	—	41	·14	1·43	14
Ross and Cromarty	—	36	·22	1·05	5
Sutherland	—	—	·43	2·67	4
Caithness	—	—	·54	1·04	3
Orkneys and Shetlands	—	—	·66	1·15	4
			TOTAL ...		150

* In accordance with the Meteorological Office definitions an absolute drought has been taken as a period of at least 15 consecutive days, to none of which is credited ·01 inch of rain or more, and a partial drought as a period of at least 29 consecutive days, the mean daily rainfall of which does not exceed ·01 inch. (See *Meteorological Glossary*, p. 62.)

was a large deficiency of rainfall, the defect being very pronounced in all except extreme northern and north-eastern districts. A preliminary examination of the rain returns reveals that absolute and partial droughts were experienced in most counties. In Table I an analysis of such returns is given covering the two months January and February. The numbers in columns (1), (2), (3), and (4) of this table do not refer to one station but to the total number of stations given in column (5). In addition to the 150 stations given there may be added 23 stations of the Glasgow Waterworks, situated mostly in Perthshire, all of which had 0·20in. or less during the month of February. The dry spell continued into March, but no actual data for March are available.

TABLE II

Contrasting totals for several stations

County	*Station*	*January* in.	*February* in.
Wigtown	Monreith	3·07	·01
Kirkcudbright ...	Garroch	12·07	·07
,, ...	Forrest Lodge ...	14·00	·16
,, ...	Chipperkyle ...	6·44	·00
Dumfries	Monaive (Glencrosh)	9·37	·07
Selkirk	Ettrick Manse ...	13·36	·35
Lanark	Hamilton	7·17	·00
Ayr	Maybole (Otterden)	6·15	·00
,, ...	Ayr	5·09	·00
,, ...	New Cumnock ...	10·11	·04
Renfrew	Greenock	10·42	·00
Dumbarton ...	Arrochar	18·82	·14
Stirling	Lennoxtown ...	7·73	·03
Argyll	Pollock House ...	19·47	·58
,, ...	Ardgour	21·19	·41
,, ...	Glen Etive	21·90	·00
,, ...	Glencroe	19·95	·09
Perth	Stronvar	14·98	·00
,, ...	Tyndrum Manse ...	20·57	·11
,, ...	Corriehichon ...	18·30	·00
Inverness	Loan	31·75	·60
,, ...	Kinlochquoich ...	29·49	·55
,, ...	Glenquoich	21·63	·54
,, ...	Fort William ...	17·12	·14

Note.– An inch of rain is approximately equal to 100 tons of water per acre.

In Table II contrasts between totals for January and February are very interesting, particularly when it is borne in mind that most of the January rainfall fell during the first three weeks of that month.

In February many places had no rainfall while at others, where there was measurable rainfall, it was the driest month on record not only for February but for any month of the year. According to a report in the *Scotsman* on March 3rd, owing to the drought " Loch Lomond at Balmaha is now only 13 inches

above its lowest point on record, the actual fall since January 16th being 6 feet 10 inches. On that date Loch Lomond, owing to the incessant rainfall, had attained a height of within 9 inches of its highest record ever recorded. The fall of 6 ft. 10 in. in the loch in such a short space of time is quite unprecedented, so far as Loch Lomond is concerned."

Throughout Scotland rivers which are generally in winter flood were lower than they are frequently in midsummer and, as a result, salmon fishing was a failure. Owing to the dryness of the countryside great care was necessary to prevent accidental heath and gorse fires. The lack of snow was prejudicial to the much desired winter sports in Scotland, snow on even the highest slopes of the Grampians being rather scarce. A great advantage of the continued dry weather, however, was that all outdoor farm work became far advanced for the season.

During February anticyclonic conditions prevailed with quiet weather, the mean barometric pressure in the Edinburgh area being the highest for any month since at least 1769.

Wind and Tide

By H. St. G. Dyke-Marsh, B.A.

An article under the above title appeared in the *Meteorological Magazine* for October, 1925, in which were given the mean wind speeds at Holyhead at times of high and low water for each month from October, 1923, to September, 1924. There proved to be no difference, taking the whole year, between the mean speeds at high and low water, which also agreed with the mean speed at all hours; no account of wind direction was taken. An investigation on similar lines was subsequently undertaken by Mr. Baxendell, of the Fernley Observatory, Southport, using the records of the Marshside anemometer, situated at the Ribble estuary. The results in this case were also negative and the two investigations clearly indicated that the height of the tide, *i.e.*, the rise and fall of the water level, has no effect on wind speed, but did nothing to suggest whether the wind speed in the lowest layers was appreciably affected by reduced or increased friction between air and water in the case of tidal streams flowing approximately with or against the wind.

This aspect of the question was first investigated statistically by Mr. Baxendell in 1926, who published the results in the *Annual Report of the Fernley Observatory for* 1925.

The winter months only were used, as it was considered sea and land breezes would mask the effect in summer, and only cases where a wind from the sea prevailed during at least seven hours centring on high water or low water were considered. The mean speeds of such " sea " winds from five hours before high water (H.W.) to five hours after it and for similar periods

before and after low water (L.W.) were obtained from the records of the Marshside anemometer and showed the effect of the tidal stream very clearly in the following tables taken from the *Annual Report of the Fernley Observatory, Southport, for* 1925 :—

	Hours before H.W.					*H.W.*	*Hours after H.W.*				
	5	4	3	2	1		1	2	3	4	5
Mean Speed	23.0	23.5	24.1	24.1	23.8	23.1	22.5	22.0	21.8	21.1	21.6
			23.7						21.8		

	Hours before L.W.					*L.W.*	*Hours before L.W.*				
	5	4	3	2	1		1	2	3	4	5
Mean Speed	21.6	21.8	21.9	22.6	23.0	23.7	24.1	24.8	24.8	23.9	23.4
			22.2						24.2		

This gives a mean difference in wind speed of 2 m.p.h. according to whether tidal stream is flowing with or against the wind, with a maximum difference of 3 m.p.h. between the hours of maximum flood and ebb streams. The anemometer vane is 77 feet above mean sea level.

Recently an effort has been made in the Naval Division of the Meteorological Office to confirm the Southport results definitely by using existing records from anemometers situated so that coastal effects would not interfere. In this respect the Bell Rock anemograms were by far the most suitable, but unfortunately the tidal stream past the Bell Rock is never strong, not usually exceeding 1 knot. An analysis of the records for 1930 was, however, made and showed a very small positive effect, but it was insufficient to prove anything. The stream runs south with the flood and north with the ebb. The method used was to take the hours when the stream was running strongest, dividing the winds into those flowing with, against and perpendicular to the stream, the last including all winds between NE. and SE. and between SW. and NW. The mean speed of southerly winds flowing with the stream was compared with that of southerly winds flowing against it and similarly for northerly winds. The mean for the year only showed mean speed of winds with the stream as 0·3 m.p.h. greater than that of winds against the stream. The anemometer vane is, however, 130 feet above mean sea level and the tidal effect probably decreases rapidly with height.

Lastly, an analysis was made of the winds entered in the logs of the East Goodwin Lightship for 1928 and 1929 kept at Trinity House. This ship was selected as the tidal streams past it were stronger than those past any other lightship. The entries were wind direction and estimated force on the Beaufort scale at three-hour intervals throughout the day, the state of the tide whether flood, ebb, high water or low water being

indicated. The observations did not usually coincide with the times of strongest tidal streams, but all observations except those at slack water were considered, most flood and ebb periods having two observations at varying phases of the flood or ebb. The directions of the tidal streams being given by Admiralty charts as 209° during flood and 29° during ebb, only winds from N. to ENE. and from S. to WSW. were included, *i.e.*, about 40° on each side of the stream direction. The mean force of all winds from N. to ENE. when flowing with the stream was compared with the mean force of winds from the same directions flowing against the stream, and similarly for S. to WSW. winds, for each month of the two years and with three small exceptions gave consistently positive results. The results over the two years were as follows:—

Mean force of N.-ENE. winds, with stream, 3·8; against stream, 3·4
" " S.-WSW. " " , 4·3; " " , 3·9
Mean difference in force, 0·4, probably equivalent to about $2\frac{1}{2}$ m.p.h. or two knots.

The mean speed of tidal streams over the whole period of flood and ebb, neap and springs being about 2 knots, the wind speed is therefore increased by about half the speed of the stream when flowing with the tide and similarly decreased when flowing against the stream.

Conclusion.—All the work done on this question has gone to indicate that changes in level of the sea have no appreciable effect on wind, but that horizontal currents or tidal streams have an effect by decreasing or increasing friction which is quite perceptible in favourable circumstances. It is probable, however, that the effect is limited to a surface layer of air of little depth.

Royal Meteorological Society

The monthly meeting of this Society was held on Wednesday, February 17th, at 49, Cromwell Road, South Kensington, Prof. S. Chapman, F.R.S., President, in the Chair.

W. H. Pick, B.Sc., F.Inst.P.—Visibility at Sea.

The main results obtained from the investigation may be summarised as under:—(*a*) The open ocean in the eastern North Atlantic is a region of singularly good visibility, both in summer and in winter. (*b*) Both in summer and in winter the highest percentages of good visibilities occur with the air temperature less than the sea temperature; but the fact that high percentages of good visibilities are also obtained with air that is warmer than the sea beneath is noteworthy. (*c*) With regard to wind force, the lowest percentages of good visibilities occur with the strongest winds. (*d*) The large majority of fogs occur with air temperature either greater than, or equal to, the sea tempera-

ture, but there is an appreciable residue that occur when the air temperature is lower than the sea temperature. (*e*) G. I. Taylor's observation that nearly all fogs occurring with air temperature lower than the sea temperature are accompanied by "very light" winds is supported so far as "summer" is concerned, but is not supported quite so well for "winter." (*f*) Just under half of all the fogs occurring do so with a wind force of 4 or more.

M. G. Bennett, M.Sc.—The visual range of lights at night and its relation to the visual range of ordinary objects by day.

The visual range of a point source of light is given by the relation that the product of the intensity of the source and the transmission coefficient of the air, divided by the square of the distance, is a constant. The author described experiments in which this constant is shown to depend on the brightness of the background, roughly according to the empirical formula:—

$$\text{constant} = 0{\cdot}12\ 10^{-4}\ B^{\frac{3}{5}}$$

where B is the brightness of the background in apparent candle power per sq. Km. (To illustrate this unit it may be remarked that a perfectly diffusing and reflecting screen illuminated by a light of one candle power at a distance of one kilometre would have a value of B equal to unity.) From these results, and their application to some observations quoted by Bigg, deductions are made as to the magnitude of the effect of background on the visual range of lights, and on the relation between the visual range of lights at night and of ordinary objects by day.

S. E. Ashmore, B.Sc.—The occurrence of fog with unsaturated air at Grayshott, Hants.

The meteorological records at Grayshott have been utilised in investigating the frequency of occurrence of fog with unsaturated air, separate consideration being given to occasions with solid or liquid precipitation or with air temperature below freezing-point. The relation of such fogs to accompanying meteorological factors, such as wind and cloud, has been analysed. Finally, an analysis of occasions of good visibility with differing humidity ranges has been made. The results have been compared with those for a few other stations. The results appear in some degree to contradict the smoke theory of unsaturated fogs.

Correspondence

To the Editor, *The Meteorological Magazine.*

Diffusion on a Cold Front

In the course of a discussion on February 15th of Palmén's paper on a cold "break through," I suggested that the cause of the

lower temperature at a distance of 100 kilometres or more in advance of the cold front of April 20th, 1929, might be due to the " diffusion " of the cold air by turbulence. I had in mind the comparatively large scale turbulence which is produced at the cold front itself, where masses of cold air will be continually breaking away from the main mass.

If the view of the cold front, as protruding over the warm air until the instability is so marked that a small catastrophe occurs, and the overhanging portion of the cold air breaks through, is correct, the turbulent masses of cold air will be large. If Giblett's view of a more or less permanent overhanging cold front, continuously renewed, is correct, the masses of cold air will be smaller. But on either view they will not be the small turbulence of an ordinary wind. As Giblett remarked: " I have observed there (*i.e.*, at the front) a most amazing state of turbulence." It is therefore reasonable to assume a large value for K, the eddy conductivity (or diffusivity). Values of K up to 7×10^8 were found by Richardson from the scatter of small free balloons, *i.e.*, the turbulence of an ordinary wind over undulating country: thus a value of 10^9 would not be excessive for the turbulence originating at a cold front. With this value of K, the order of magnitude of the time required for the turbulence to carry cold air (in appreciable quantity) 100 kilometres in advance of the front is (in seconds):—

$$5 \times 10^4 \text{ or about } 14 \text{ hours,}$$

using the formula $\sigma^2 = 2Kt$, and assuming that the forward velocity of the cold front is approximately equal to the component velocity of the warm air (not just at the surface but at an altitude of 1,000 feet or more) at right angles to the front. This is of the right order of magnitude and indicates that the pre-frontal cooling may be merely another phenomenon of turbulence, and that the extent of its advance ahead of the front will be mainly a function of the age of the front.

E. GOLD.

February 16th, 1932.

A Snowless Winter

Last autumn the press made laudable efforts to encourage winter sports in Scotland. There was " every sign of a hard winter "; so said the writers. But the weather took exception to these remarks. Owing to the intense anticyclonic conditions since mid-January and the exceptional mildness preceding them, Scotland seems to have had the most snowless winter on record, Mr. Seton Gordon, writing from Skye on February 9th, said that there was no snow at all on the Cuillins or the higher Rossshire hills of 3,500ft. Such a state of things must be unprecedented in living memory. At the end of February Ben

Nevis had only a slight coating on its upper 500ft. instead of a normal depth of 6ft. extending down to 1,000ft. or so above sea level. The Fort William rainfall in February was only 0·14in., which must be a record for any month at that wet station. All the Scottish salmon rivers are at low summer level and prospects hopeless at the time of writing, since there are no vast accumulations of snow on the hills to keep up their level through the early summer as is invariably the case. The February rainfall here was 0·16in., driest in 26 years' observations at this station and for the 44 days since January 16th (when the wet spell ended) 0·24in.

R. P. Dansey.

Kentchurch Rectory, Hereford. March 1st, 1932.

The Persistent Drought

Since January 16th no measurable quantity of rain has been collected in my gauge. Technically, therefore, the drought here, up to date, has been unbroken for forty-seven days, nor is there immediate indication of change.

Drizzle gave "traces" on January 21st and February 23rd. Further there were a few drops from fog deposit on three or four days early last month, which perhaps nearly totalled to 0·01in. About 6 a.m. on the 10th there was a brief squall of powdery snow, but the gauge gave only a few drops on melting. As it lay, however, $\frac{1}{3}$in. deep, I have entered it as 0·02in.

This presumably divides the period into two "absolute droughts" of 24 and 22 days for recording purposes.

At York in February, 1891, no rain actually fell, but there was a smart shower at 6 a.m. March 1st.

J. Edmund Clark.

Portway Street, Somerset. March 3rd, 1932.

This drought, having lasted 51 days, ended soon after noon March 8th—0·29in. of rain was measured at 9 a.m. on the 9th. Presumably rain ceased about midnight as frost (32°F.) followed.

J. E. Clark.

March 9th, 1932.

The Drought and High Pressure of February

February last has been the driest calendar month on record, and the mean barometric pressure the highest for any calendar month since 1848, when systematic observations were commenced at Stonyhurst Observatory.

The total rainfall in February was 0·13in., the previous driest February being in 1858 with a fall of 0·31in. The previous driest calendar month was May, 1859, with a fall of 0·25in.

The mean barometric pressure, reduced to mean sea-level, for

February this year was 30·538in. (1034·1mb.)—the previous record for any calendar month being 30·449in. (1031·1mb.) in February, 1891.

Further the mean barometric pressure, reduced to mean sea-level during the period January 17th to February 29th this year, a period of 44 days, when the British Isles were definitely under anticyclonic influence was 30·550in. (1034·5mb.), a higher mean than that for February. The highest reading recorded during this period was on January 26th, 31·035in. (1051·0mb.), at 11h. 30m. G.M.T. In the last 85 years this has only been exceeded once, namely, on 1896, January 26th, when the reading was 31·062in. (1051·9mb.).

E. D. O'Connor, S.J.

Stonyhurst College Observatory, Nr. Blackburn, March 6th, 1932.

Extreme Barometric Maxima in pairs

In Vol. 37 (1902) of this magazine, pp. 6 and 23, and in Vol. 40 (1905), p. 3, attention was drawn to an apparent tendency for instances of extremely high barometric pressure in the British Isles to occur in pairs separated by an interval of two to four weeks. The examples given were as follows :—

Year.	Date of first maximum.	Date of second maximum.	Interval in days.
1821	Jan. 23	Feb. 5	13
1825	Jan. 9	Jan. 28	19
1834-5	Dec. 15	Jan. 2	18
1882	Jan. 18	Feb. 1	14
1896	Jan. 9	Jan. 30	21
1902	Jan. 14	Jan. 31	17
1905	Jan. 1	Jan. 28	27

There is no precise statement of the criteria used in the formation of this list, but the pressure limit seems to have been set not lower than 1047mb. in respect of the dominant member of at least six out of the seven pairs. Most of what may be termed Britain's "classical" maxima) 1050mb. and above) are represented.

Another instance of such a recurrence has been furnished by the first two months of the present year. The exceptional barometric elevation of January 26th, when 1050mb. was slightly exceeded in the north of England (see the February issue of this magazine, p. 18), was followed 25 days later by a secondary maximum within 3mb. of that figure. In the *Daily Weather Report*, British section, of February 21st, 1047·4mb. is given as the reading for 13h. on February 20th at Inchkeith, Renfrew and Donaghadee.

Meteorology has made good headway since 1905, and not a few phenomena that could merely be recorded then have now been

explained. It would be interesting to know whether any modern theory can account for an oscillation with a period of the order of two to four weeks in the intensity of a powerful and long-lived anticyclone established over or near our islands during winter, and also whether the tendency for extreme barometric maxima to be duplicated within a month has been observed in other parts of the world.

E. L. HAWKE.

"*Caenwood*," *Rickmansworth, Herts. March 2nd*, 1932.

Bands of Foam on the Dead Sea

The Dead Sea seen from the air during a gale on February 7th, 1932, presented a striking appearance. The height of the aircraft was about 4,000 feet, and at this height the wind was south-westerly 65-70 m.p.h. The wind in the deep depression near the Dead Sea was therefore probably S.-SSW., force 6-8. The surface of the sea was " moderate " on the sea disturbance scale, but the striking feature was the parallel bands of white foam which ran the whole length of the sea. These bands were orientated roughly south by west to north by east—i.e., slightly across the sea's major axis. The impression was that the lines of foam were interference bands due to two sets of waves or to one set of waves and their reflections from one shore.

As the sea was obscured at times by cloud and rain, it was not possible to count the number of bands accurately, but it is estimated that there were about 20 between the east and the west shore.

J. DURWARD.

Meteorological Office, Heliopolis. February 17th, 1932.

[The Dead Sea has a length of 47 miles and is 9½ miles across at its widest part, so that the bands of foam referred to would be somewhat less than a half-mile apart. According to the *Encyclopædia Britannica* a line of white foam extends along the axis of the lake almost every morning. This was supposed by Blanckenhorn to mark the line of a fissure under the bed of the lake (which lies along the line of a great geological fault), but has also been explained as a consequence of the current of the Jordan.—ED. *M.M.*]

NOTES AND QUERIES

Retirement of Father Louis Froc, S.J.

At the end of August, 1931, Father Louis Froc retired from the post of Director of Zi-ka-wei Observatory, Shanghai, which he had held since 1896. During that period he organised and maintained the system of daily weather reports and typhoon warnings issued by the Observatory, to the great benefit of the world's

shipping, and was untiring in his study of the storms of the China Seas. Among his monographs on this subject may be mentioned the " Iltis " typhoon of July 22nd-25th, 1896, the " De Witte " typhoon of August 1st-6th, 1901, the " Chinhai " typhoon of July 28th, 1915, and the typhoon of August 8th-23rd, 1924, which followed an extraordinary looped track. As early as 1896 he issued the first part of a study of " Typhoon Highways in the Far East," and in 1920 he completed this work with an atlas giving the tracks of 620 typhoons between 1893 and 1918, which was recently brought up to date in a new edition. Father Froc also supervised a number of studies of the climatology of China, and in 1912 he prepared a work on " La pluie en Chine," which included eleven years' data for a region the greater part of which had previously been meteorologically almost unknown.

Father Froc's departure from Shanghai was the occasion of a series of receptions and presentations in his honour by the local authorities and the various Marine Societies.

Abstracts of Meteorological Literature

In scientific research, one of the essentials is a knowledge of what has already been done in any particular subject, but with the rapidly increasing output of scientific literature, such knowledge is becoming more and more difficult to attain. The first step is obviously to get references to the literature of one's subject, and for a number of years that need was met by the *International Catalogue of Scientific Literature*, commenced under the auspices of the Royal Society in 1901. This enterprise ceased in 1916, but the meteorological part has been continued in the Royal Meteorological Society's *Bibliography*, in which the same subject classification is employed. A file of the latter publication, rearranged under narrower sub-divisions and pasted on sheets, is kept in the Meteorological Office Library, where it is frequently consulted.

A bibliography alone is not enough, however, for it may show dozens of papers on the subject required; science, like art, is long, but life is short. To assist the quest, a commencement has been made in the formation of a complementary collection of "Abstracts," similarly classified under subjects, each abstract giving a brief summary of the main arguments or conclusions of a single paper. The sources from which the collection is being made are various; in the first place author's own summaries are being copied or translated where they are available, and publications such as *Science Abstracts* are being ransacked. For the literature of past years, the series of " Meteorological Office Abstracts " compiled by members of the staff forms an invaluable basis. In one way and another a collection of about a thousand

abstracts and summaries has already been formed, but this covers a period of nearly ten years and is still only the merest skeleton. If the plan is to attain its ideal development, every important paper published in future must be represented, and where a summary is not given by the author, one must be made. This is an ambitious project, but a number of meteorologists have volunteered their assistance and the prospects appear to be hopeful. The collection of abstracts will be kept in the Library, and should ultimately become a tool of real value in meteorological research.

Exhibition by the Royal Meteorological Society in Edinburgh

In view of the interest aroused by the exhibition held in the Science Museum, London, during January and February, a similar exhibition is being arranged by the Royal Meteorological Society in the Royal Scottish Museum, Edinburgh, by permission of the Director, Mr. E. Ward. The exhibition will be opened during the first week in April and will remain open for about three months.

Wet week-ends in 1931

Mr. James Cleland reports the following rainfall amounts on the various days of the week during 1931 at Gorway, near Walsall, in Staffordshire:—

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6·37	1·68	3·15	3·04	5·32	5·26	6·71

Total 31·53 in. on 156 days.

The "day" covers the 24 hours beginning at 9 a.m.

These statistics are of interest in comparison with similar values for Lympne Air Port given by Mr. H. E. Carter.* They are also of interest in comparison with those given by Dr. J. R. Ashworth, in a paper in which he argued that the large quantities of coal consumed in manufacturing towns produced an upward current of hot air sufficient to influence the rainfall. For a period of 30 years at Stonyhurst he found that the average rainfall on week-days was 6 per cent. more than the average on Sundays.†

* *Meteorological Magazine* 66, 1931, p. 163.
† *Ibid.* 64, 1929, p. 109.

Reviews

Veröffentlichungen des Forschungs—Institutes der Rhön-Rossitten-Gesellschaft e.V. Nr. 4. Jahrbuch, 1929. Edited by Dr. W. Georgii. Munich and Berlin, 1931.

This volume maintains the high standard of previous year-

books, and should be studied by all interested in gliding flight and associated problems. The first part of the book is devoted to the work of the Research Institute during the year, and on the meteorological side this consists mainly of measurements of upward currents, which now include observations from aeroplanes. The vertical motion of the atmosphere is a complicated process, thermal and dynamical factors being simultaneously involved. K. O. Lange contributes a long paper on the use of balanced pilot balloons. In the earlier part of the paper various sources of error, such as temperature changes, insolation and leakage are discussed, probably more thoroughly than ever before. The results of the actual investigation of the air motion are set out with the aid of numerous diagrams. Once the air stream breaks into eddies, the effect of a hill extends far to leeward, to a distance very large in comparison with the height of the hill.

Some aerological data are also published. In this connexion it may be mentioned that meteorological flights are being made from five German aerodromes, the observations being published in the *Aerologische Berichte* (Berlin). This mass of data should prove useful to anyone investigating upper air temperatures, though of course the area where observations are available, from England to Germany, is much too small.

C. K. M. Douglas.

The wind at Agra and its structure. By Barket Ali, M.Sc. Memoirs of the Indian Meteorological Department, Vol. XXV, Part VI.

The author discusses the prevailing surface winds, diurnal variation, wind structure with reference to gustiness, squalls, eddy viscosity and eddy energy, and the correlation of surface with upper winds in India. The results of G. I. Taylor, W. Schmidt and L. F. Richardson are applied to the diurnal variation with satisfactory results. Some discrepancies are attributed to a plateau-plain effect. The correlation of surface winds with winds up to 1 Km. is found to be less than that at St. Omer, which is used for comparison. Considerable detail is given, and the paper should be consulted.

India Meteorological Department, Scientific Notes, Vol. III, No. 18, *The structure of the Madras storm of January*, 1929, by K. R. Ramanathan, M.A., D.Sc., and A. A. Narayana Iyer, B.A., and *No.* 19, *Distribution of air density at M.S.L. over India*, by U. N. Ghosh, M.Sc.

In view of the doubt which has frequently been expressed regarding the existence of fronts in depressions near the equator, the first of these two notes is of much interest. The records quoted show a zone of rapid change of wind direction and speed, tem-

perature and vapour pressure at the trough of the depression discussed. The changes at the surface are of the type associated with diffuse warm fronts or occlusions. The work marks a definite forward step in the structural analysis of such depressions, and it is to be hoped that more complete examinations on these lines will become possible later on.

The second paper gives charts of the monthly and annual mean distribution of air density over India. The isopycnics are found to be in general similar to the isotherms of the corresponding periods. The changes from season to season are also shown diagrammatically.

Aerology. A ground school manual in aeronautical meteorology. By C. J. Maguire, S.M. Size 9 × 6in., pp. xii + 136, *Illus.* London, McGraw-Hill Publishing Co. Ltd.

This admirable book fulfils a want which has been long felt by "all-weather" aviators. It has a threefold aim: (1) to give the students of aeronautics an adequate knowledge of the medium through which all air traffic must navigate; (2) to show the principles upon which a weather service is based; and (3) to enable the airman to interpret, in the light of weather phenomena around him, the various advices available to him.

The ground covered is roughly that embraced in the syllabus for a second-class navigator in this country and, apart from the fact that pressure is still given in inches of mercury, English pilots would find that the several chapters would amply repay careful reading.

In plan it follows conventional lines and deals in turn with a weather bureau; the various weather elements; the weather map; the relation between wind and pressure, the vertical structure of the atmosphere, convection, &c.

The chapter on the construction of a weather map is especially clearly written. It is a subject which to the average aviator is fuller of snags than the expert generally realises, while the formation of ice on aircraft and the means of combating the same, is a topic not without importance, even in England, and useful information is given under this heading.

There are one or two minor blemishes. The definitions of dense fog given on pp. 31 and 32 are somewhat contradictory, while instability is hardly a character which one would apply to the air in a warm sector (p. 100), but on the whole the book fulfils its purpose in a thoroughly commendable manner.

S. F. WITCOMBE.

Smithsonian Meteorological Tables. 5th revised edition. Size 9 × 6 in. pp. lxxxvi + 282. Smiths. Inst. Misc. Coll. 86, 1931.

These tables will need no recommendation to those who have had

occasion to use the earlier editions for finding their way in the confusion of units which afflicts meteorology, involving computations in barometric inches, millimetres and millibars, Fahrenheit, Centigrade and Absolute temperatures, inches and centimetres, feet and metres, miles per hour and metres per second. The changes which have been made since the publication of the previous edition in 1918 mainly reflect innovations in meteorological practice since that date; the introduction of the "dynamic metre" in upper-air work involves the addition of five new tables; the list of international meteorological symbols now includes those for mirage, exceptional visibility and duststorm. A new table shows the energy distribution and atmospheric transmission of solar radiation. The tables for computation of mean wind direction by Lambert's formula have been omitted—this is little to be regretted as in practice the computation is easily carried out with the aid of a slide-rule. The new edition is said to be corrected to January, 1931. The energy of the Smithsonian Institution in keeping these tables abreast of current meteorological practice is much to be commended.

S. T. A. MIRRLEES.

Soil Temperatures in the United States. By Edith M. Fitton and Chas. F. Brooks. Reprinted from the Monthly Weather Rev., Washington, D.C., 59, 1931, pp. 6-16.

Observations of soil temperatures for 32 stations in the United States are discussed in this paper. From the data available comparisons are made between air and soil temperatures, and the variations of diurnal and annual range of temperature in various soils, under different cover crops and at different depths are noted.

Tables of mean monthly soil temperatures and diurnal and monthly range are given, with a comprehensive bibliography.

Books Received

Apia Observatory, Samoa. Report for 1927. Wellington, 1929.

Die Forschungsstation auf dem Jungfraujoch (3,457 m.), by Dr. W. Mörikofer (reprinted from xxxix Jahresbericht des Sonnblick-Vereines, 1930. Wien, 1931).

Obituary

Mr. Wilson A. Bentley.—We regret to learn of the death on December 23rd, 1931, of Mr. Wilson A. Bentley. Mr. Bentley was a farmer in Vermont, and all his life he made a hobby of photographing snow crystals, of which he formed a collection of more than 5,000. Shortly before his death a selection of these, the sifted results of 46 years' labour, were published in the form of an album, with a descriptive preface by Dr. W. J.

Humphreys. A review of this book will appear in the April issue of the *Meteorological Magazine*.

News in Brief

Dr. W. J. Humphreys has been appointed Editor of the *Monthly Weather Review* in succession to the late Professor Alfred J. Henry.

Dr. Charles F. Brooks has been appointed Director of the Blue Hill Meteorological Observatory and Professor of Meteorology at Harvard University, in succession to Professor A. McAdie, who is retiring.

Mr. Andrew Thomson has resigned from the New Zealand Meteorological Service to become meteorologist in the Canadian Meteorological Service at the Central Office in Toronto.

A cheerful company assembled at the Royal Hotel, Woburn Place, London, W.C.1, on February 12th, for the 13th Annual Soirée of the Meteorological Office. Dancing occupied a large part of the evening between 7.30 p.m. and midnight, but time was found for two generous items of entertainment by Mr. Leonard Henry, one or two competitions with prizes and, in addition, an interval for refreshments accompanied by that necessary ingredient of a soirée, conversation.

The attendance was somewhat smaller than usual, especially as far as the nearer outstations were concerned, but no doubt this was due more to budgetary considerations, than to the fact that this soirée was the 13th of the series.

The Eleventh Annual Dinner of the staff of the Meteorological Office, Shoeburyness, was held at the Queen's Hotel, Westcliff, on February 6th.

The Weather of February, 1932

The main characteristics of the weather of February over the British Isles were abnormally high barometric pressure, unusually dry weather and a persistence of northerly and easterly winds. On the whole, too, conditions were mild in Scotland, but cold elsewhere. The anticyclone régime which was inaugurated in the last ten days of January persisted throughout February.* No centre of low pressure crossed the country during the month. The general paucity of rainfall was remarkable. Many places recorded "absolute droughts" of varying duration. At Trecastle (Brecon), Seathwaite (Cumberland), Cranmere (Devon), and several places in Scotland,† the drought lasted the

* See page 29. † See page 32.

whole month, at Liverpool from the 4th - 29th, at Lyndhurst (Hants), from the 1st-22nd. Many of the totals were also the smallest for this month since records began. At Ross-on-Wye a smaller February rainfall has been recorded in only two years, 1891, 1895, since records commenced in 1818. In England and parts of Ireland there were two spells of very cold weather, both due to the incursion of strong easterly winds from the interior of the continent. Gales occurred locally in the southern part of the country on both occasions. In the first spell, 10th-12th, snow fell over the whole of Great Britain, the Channel Islands and eastern Ireland, a depth of 1½ in. was recorded at Birmingham on the 12th, but generally the amounts were small. In spite of sunny intervals temperature was very low during this period, remaining below the freezing point on the 10th in east and south-east England and the Midlands; 28° F. was the maximum at Croydon, Lympne and Rothamsted. The second cold spell occurred on the 28th and 29th when a maximum of 33° F. was recorded at Boscombe Down on the 29th. The 19th was also a very cold day in the Midlands. One of lowest minima in the screen for the month was 18°F. at Markree Castle on the 19th. In Scotland temperature rarely fell below 40° F. throughout the month and exceeded 50° F. on some occasions, 54° F. was recorded at Renfrew on the 19th, and at Dundee, Leuchars and Renfrew on the 23rd. Sunshine totals for the month were generally below normal except in parts of west Scotland, Wales and west Ireland; Eskdalemuir had as much as 48 hours in excess of the normal. The sunniest days of the month were the 10th, 18th, 21st, 27th and 28th, also the 6th in the south-east, and the 15th and 19th in the west and north; on all of these days over 8 hrs. bright sunshine was recorded locally. Hastings had 9·1 hrs. and Brighton 9·0 hrs. on the 18th. The distribution of bright sunshine for the month was as follows:—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs.)
Stornoway	67	+ 9	Liverpool	59	— 9
Aberdeen	59	—14	Ross-on-Wye	58	—13
Dublin	52	—21	Falmouth	87	+ 4
Birr Castle	62	— 5	Gorleston	76	— 5
Valentia	81	+12	Kew	46	—14

The special message from Brazil states that in the northern and central regions the rainfall was scarce with 1·65in. and 0·24in. below normal respectively, while in the southern regions it was copious with 1·22in. above normal. Conditions favourable for the crops. Four anticyclones passed across the country. At Rio de Janeiro pressure was 0·8mb. below normal and temperature 0·7°F. above normal.

Miscellaneous notes on weather abroad culled from various sources. Snowstorms were experienced generally in eastern Greece and the

Black Sea on the 4th-6th and the 13th-15th, and bitterly cold weather accompanied by severe snowstorms in many places was recorded throughout France on the 10th and 11th; as far south as Marignane a maximum temperature of 31·5°F. occurred on the 11th, and a screen minimum of 14° F. on the night of the 11th-12th. In Loraine the heavy snowfall delayed many trains. Owing to the intense cold in Switzerland about the 15th, three people died and the rivers and minor lakes were frozen. Severe cold and heavy falls of snow were reported from south-eastern Europe from about the 20th to the end of the month. Heavy falls of snow also occurred in the region of Avellino and the Province of Molise (Italy) about the 20th. This snowy weather spread over Italy and France towards the end of the month. Snow was reported both from Rome and Naples on the 27th and also from Marseilles and Avignon. The rainfall which occurred at the end of the month in Cyprus is considered to have saved the wheat crop there, although it came too late to save the barley and the early lambs (*The Times*, February 5th-29th, 1931).

Snowstorms occurred over the Syrian Desert about the 7th and a little later Mosul experienced the severest cold recorded there for several years. Snow fell over nearly the whole Liwa (*The Times*, February 8th-11th, 1932).

The cyclone which struck Réunion in the Indian Ocean on the 5th was said to be the worst in the history of the island—45 people were killed (*The Times*, February 6th-10th, 1932).

Bush fires occurred round Melbourne early in the month following on 43 days' drought, but this was followed by heavy rains about the 5th. A long drought in the Canterbury Plain, New Zealand, was broken on the 19th (*The Times*, February 6th-20th, 1932).

Severe cold was recorded in Newfoundland during the first days of the month, the temperature at St. Johns was −8° F. on the night of the 2nd-3rd, and a temperature of −45° F. was reported from Badger in the interior. Except at times along the Pacific Coast and in the Mountain Region, temperature was above normal in the United States throughout the month and was over 20°F. above normal in the Missouri Valley during the week ending March 1st, while rainfall was about normal, except in the Gulf States during the week ending the 23rd, when it was considerably in excess. Severe gales occurred in the Atlantic and the Bay of Biscay about the 15th (*The Times*, February 4th-5th, 1932, and *Washington, D.C., U.S. Dept. Agric., Weekly Weather and Crop Bulletin*).

Rainfall, February, 1932—General Distribution

England and Wales	18	per cent of the average 1881-1915.
Scotland	12	
Ireland	7	
British Isles	14	

Rainfall: February, 1932: England and Wales

Co.	Station	In.	Per-cent of Av.	Co.	Station	In.	Per-cent. of Av.
Lond.	Camden Square.....	·27	16	*Leics.*	Belvoir Castle.....	·57	34
Sur.	Reigate, Alvington....	·54	25	*Rut.*	Ridlington.....	·64	39
Kent.	Tenterden, Ashenden...	·53	27	*Linc.*	Boston, Skirbeck.....	·66	45
,, .	Folkestone, Boro. San..	·61	...	,, .	Cranwell Aerodrome...	·60	40
,, .	Margate, Cliftonville...	·30	22	,, .	Skegness, Marine Gdns	·50	33
,, .	Sevenoaks, Speldhurst	·65	...	,, .	Louth, Westgate.....	·77	40
Sus.	Patching Farm.....	·19	9	,, .	Brigg, Wrawby St.....	·54	...
,, .	Brighton, Old Steyne..	·07	3	*Notts.*	Worksop, Hodsock.....	·43	28
,, .	Heathfield, Barklye....	·47	26	*Derby.*	Derby, L. M. & S. Rly.	·26	16
Hants.	Ventnor, Roy. Nat. Hos.	·08	4	,, .	Buxton, Devon Hos....	·40	11
,, .	Fordingbridge, Oaklnds	·04	2	*Ches.*	Runcorn, Weston Pt...	·09	5
,, .	Ovington Rectory.....	·15	6	,, .	Nantwich, Dorfold Hall	·15	...
,, .	Sherborne St. John.....	·11	5	*Lancs.*	Manchester, Whit. Pk.	·09	5
Berks.	Wellington College.....	·09	5	,, .	Stonyhurst College.....	·13	4
,, .	Newbury, Greenham...	·16	7	,, .	Southport, Hesketh Pk	·05	2
Herts.	Welwyn Garden City...	·26	...	,, .	Lancaster, Strathspey	·07	...
Bucks.	H. Wycombe, Flackwell	·21	...	*Yorks.*	Wath-upon-Dearne.....	·43	26
Oxf. .	Oxford, Mag. College..	·09	6	,, .	Bradford, Lister Pk....	·76	32
Nor.	Pitsford, Sedgebrook...	·36	22	,, .	Oughtershaw Hall.....	·75	...
,, .	Oundle.....	·35	...	,, .	Wetherby, Ribston H.	·41	24
Beds.	Woburn, Crawley Mill	·23	16	,, .	Hull, Pearson Park.....	·64	39
Cam.	Cambridge, Bot. Gdns.	·25	20	,, .	Holme-on-Spalding.....	·59	...
Essex.	Chelmsford, County Lab	·23	16	,, .	West Witton, Ivy Ho.	·53	32
,, .	Lexden Hill House....	·35	...	,, .	Felixkirk, Mt. St. John	·97	57
Suff.	Haughley House.....	·31	...	,, .	Pickering, Hungate....	·98	56
,, .	Campsea Ashe	·50	36	,, .	Scarborough.....	·77	46
Norf.	Norwich, Eaton..... ...	·87	53	,, .	Middlesbrough.....	·86	66
,, .	Wells, Holkham Hall	·72	49	,, .	Baldersdale, Hury Res.	·50	...
,, .	Swaffham, The Villa...	1·28	79	*Durh.*	Ushaw College.....	1·04	65
Wilts.	Devizes, Highclere.....	·07	4	*Nor.*	Newcastle, Town Moor	·74	47
,, .	Bishops Cannings.....	·10	5	,, .	Bellingham, Highgreen	·61	24
Dor.	Evershot, Melbury Ho.	·03	1	,, .	Lilburn Tower Gdns....	·75	38
,, .	Creech Grange.....	·13	5	*Cumb.*	Geltsdale.....	·39	...
,, .	Shaftesbury, Abbey Ho.	·06	3	,, .	Carlisle, Scaleby Hall	·11	5
Devon.	Plymouth, The Hoe...	·04	1	,, .	Borrowdale, Seathwaite	·00	0
,, .	Launceston, Werringt'n	·07	2	,, .	Borrowdale, Moraine...	·05	...
,, .	Holne, Church Pk. Cott.	·04	1	,, .	Keswick, High Hill.....	·06	...
,, .	Cullompton	·03	1	*West.*	Appleby, Castle Bank..	·37	13
,, .	Sidmouth, Sidmount...	·07	3	*Glam.*	Cardiff, Ely P. Stn....	·02	1
,, .	Filleigh, Castle Hill....	·01	...	,, .	Treherbert. Tynywaun	·14	...
,, .	Barnstaple. N. Dev. Ath	·12	4	*Carm.*	Carmarthen Friary.....	·02	1
,, .	Dartm'r, Cranmere Pool	·00	..	*Pemb.*	Haverfordwest, School	·08	2
Corn.	Redruth, Trewirgie.....	·04	1	*Card.*	Aberystwyth.....	·12	...
,, .	Penzance, Morrab Gdn.	·03	1	,, .	Cardigan, County Sch.	·02	...
,, .	St. Austell, Trevarna...	·09	2	*Brec.*	Crickhowell, Talymaes	·25	...
Soms.	Chewton Mendip.....	·11	3	*Rad.*	Birm W. W. Tyrmynydd	·18	3
,, .	Long Ashton.....	·05	2	*Mont.*	Lake Vyrnwy.....	·18	4
,, .	Street, Millfield	·02	1	*Denb.*	Llangynhafal.....	·26	12
Glos. .	Blockley.....	·24	...	*Mer.*	Dolgelly, Bryntirion...	·07	2
,, .	Cirencester, Gwynfa....	·09	4	*Carn.*	Llandudno.....	·14	7
Here.	Ross, Birchlea.....	·14	7	,, .	Snowdon, L. Llydaw 9	·20	...
,, .	Ledbury, Underdown..	·18	10	*Ang.*	Holyhead, Salt Island	·21	8
Salop.	Church Stretton.....	·20	9	,, .	Lligwy.....	·07	3
,, .	Shifnal, Hatton Grange	·20	12	*Isle of Man*			
Worc.	Ombersley, Holt Lock	·14	9		Douglas, Boro' Cem....	.15	5
War.	Birmingham, Edgbaston	·29	17	*Guernsey*			
Leics.	Thornton Reservoir....	·57	34		St. Peter P't. Grange Rd.	·87	35

Rainfall : February, 1932 : Scotland and Ireland

Co.	Station	In.	Per-cent of Av.	Co.	Station	In.	Per-cent. of Av.
Wigt .	Pt. William, Monreith	·01	0	*Suth* .	Melvich	·71	...
,, .	New Luce School	·04	1	,, .	Loch More, Achfary	2·67	40
Kirk .	Carsphairn, Shiel	·17	3	*Caith* .	Wick	·54	24
Dumf. .	Dumfries, Crichton, R.I	·07	...	*Ork* .	Pomona, Deerness	·66	22
,, .	Eskdalemuir Obs.	·18	2	*Shet* .	Lerwick	1·15	36
Roxb .	Branxholm	.26	10	*Cork* .	Caheragh Rectory	·67	...
Selk .	Ettrick Manse	·35	8	,, .	Dunmany Rectory	·72	12
Peeb .	West Linton	·25	...	,, .	Ballinacurra	·33	9
Berk .	Marchmont House	·67	32	,, .	Glanmire, Lota Lo	·18	5
Hadd .	North Berwick Res.	·33	21	*Kerry.*	Valentia Obsy.	·45	9
Midl .	Edinburgh, Roy. Obs.	·18	11	,, .	Gearahameen	·40	...
Lan .	Auchtyfardle	·10	...	,, .	Killarney Asylum	·08	2
Ayr .	Kilmarnock, Kay Pk.	·05	...	,, .	Darrynane Abbey	·32	7
,, .	Girvan, Pinmore	·05	1	*Wat* .	Waterford, Gortmore	·35	11
Renf .	Glasgow, Queen's Pk.	·01	0	*Tip* .	Nenagh, Cas. Lough	·33	11
,, .	Greenock, Prospect H.	·00	0	,, .	Roscrea, Timoney Park	·14	...
Bute .	Rothesay, Ardencraig.	·22	5	,, .	Cashel, Ballinamona	·07	2
,, .	Dougarie Lodge	·05	...	*Lim* .	Foynes, Coolnanes	·12	4
Arg .	Ardgour House	·41	...	,, .	Castleconnel Rec.	·13	...
,, .	Glen Etive	·00	0	*Clare* .	Inagh, Mount Callan	·10	...
,, .	Oban	·06	1	,, .	Broadford, Hurdlest'n.	·15	...
,, .	Poltalloch	·10	2	*Wexf.* .	Gorey, Courtown Ho	·17	6
,, .	Inveraray Castle.	·03	0	*Kilk* .	Kilkenny Castle	·17	7
,, .	Islay, Eallabus	·09	2	*Wic* .	Rathnew, Clonmannon	·30	...
,, .	Mull, Benmore	2·00	...	*Carl* .	Hacketstown Rectory.	·36	12
,, .	Tiree	·26	...	*Leix* .	Blandsfort House	·30	11
Kinr .	Loch Leven Sluice	·11	4	,, .	Mountmellick	·32	...
Perth .	Loch Dhu	·10	1	*Off'ly* .	Birr Castle	·23	10
,, .	Balquhidder, Stronvar	·00	...	*Kild'r.*	Monasterevin	·17	...
,, .	Crieff, Strathearn Hyd.	·16	5	*Dubl* .	Dublin, FitzWm. Sq.	·19	10
,, .	Blair Castle Gardens	·14	5	,, .	Balbriggan, Ardgillan.	·23	12
Angus.	Kettins School.	·16	8	*Me'th* .	Beaupare, St. Cloud	·39	...
,, .	Dundee, E. Necropolis	·11	6	,, .	Kells, Headfort	·30	11
,, .	Pearsie House	·18	...	*W.M.* .	Moate, Coolatore	·20	...
,, .	Montrose, Sunnyside	·16	6	,, .	Mullingar, Belvedere	·19	7
Aber .	Braemar, Bank	·18	6	*Long* .	Castle Forbes Gdns	·15	5
,, .	Logie Coldstone Sch.	...	...	*Gal* .	Ballynahinch Castle	·22	4
,, .	Aberdeen, King's Coll.	·31	15	,, .	Galway, Grammar Sch.	·13	...
,, .	Fyvie Castle	·98	44	*Mayo* .	Mallaranny	·08	...
Moray.	Gordon Castle	·61	32	,, .	Westport House	·32	8
,, .	Grantown-on-Spey	·60	28	,, .	Delphi Lodge	·34	4
Nairn.	Nairn, Delnies	·44	24	*Sligo* .	Markree Obsy.	·18	5
Inv. .	Ben Alder Lodge	·14	...	*Cav'n* .	Belturbet, Cloverhill	·02	1
,, .	Kingussie, The Birches	·19	...	*Ferm* .	Enniskillen, Portora	·07	...
,, .	Loch Quoich, Loan	·60	...	*Arm* .	Armagh Obsy	·12	5
,, .	Glenquoich	·54	5	*Down* .	Fofanny Reservoir	·88	...
,, .	Inverness, Culduthel R.	·55	...	,, .	Seaforde	·15	5
,, .	Arisaig, Faire-na-Squir	·44	...	,, .	Donaghadee, C. Stn.	·12	5
,, .	Fort William, Glasdrum	·14	...	,, .	Banbridge, Milltown	·18	...
,, .	Skye, Dunvegan	·63	...	*Antr* .	Belfast, Cavehill Rd	·20	...
R & C. .	Alness Ardross Cas.	·36	11	,, .	Glenarm Castle	·23	...
,, .	Ullapool	1·05	24	,, .	Ballymena, Harryville	·22	6
,, .	Torridon, Bendamph	...	...	*Lon* .	Londonderry, Creggan	·25	8
,, .	Achnashellach	·90	...	*Tyr* .	Omagh, Edenfel	·25	8
,, .	Stornoway	·59	...	*D.n* .	Malin Head	·15	...
Suth .	Lairg	·43	14	,, .	Dunfanaghy	·49	...
,, .	Tongue	1·23	35	,, .	Killybegs, Rockmount	·09	2

Climatological Table for the British Empire, September, 1931

STATIONS	PRESSURE		TEMPERATURE						Relative Humidity	Mean Cloud Am'nt	PRECIPITATION			BRIGHT SUNSHINE	
			Absolute		Mean Values			Mean							
	Mean of Day M.S.L.	Diff. from Normal	Max.	Min.	Max.	Min.	½ max. and min.	Diff. from Normal	Wet Bulb		Am'nt	Diff. from Normal	Days	Hours per day	Percentage of possible
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F	°F.	%	0—10	in.	in.			
London, Kew Obsy.	1021·7	+ 4·3	68	38	60·3	48·2	54·3	— 2·8	49·2	91	6·9	2·09	+ 0·22	10	3·9	31
Gibraltar	1016·1	— 1·2	88	57	78·7	64·4	71·5	— 1·0	63·4	85	4·7	1·46	+ 0·07	7	..	..
Malta	1015·7	— 0·6	93	62	79·8	69·3	74·5	— 1·5	68·3	73	3·3	0·65	— 0·62	4	9.2	74
St. Helena	1016·4	+ 0·2	67	52	59·5	53·6	56·5	— 0·9	54·3	94	9·7	2·51	..	18	..	..
Sierra Leone	1013·5	+ 1·3	87	68	82·9	69·4	76·1	— 3·0	75·4	89	7·9	27·27	— 1·21	28	..	..
Lagos, Nigeria	1012·5	— 0·3	88	70	83·6	74·9	79·3	+ 0·9	75·2	83	8·9	12·54	+ 7·28	20	..	..
Kaduna, Nigeria	1013·1	— 1·2	89	65	86·7	68.3	77·5	+ 2·2	72·0	87	8·3	9·25	— 2·24	24	..	..
Zomba, Nyasaland	1012·6	— 1·1	88	47	82·2	58·6	70·4	+ 0·9	..	54	1·8	0·42	+ 0·08	2	..	..
Salisbury, Rhodesia	1011·9	— 0·7	91	40	82·4	54·7	68·5	+ 2·1	52·6	31	1·2	0·00	— 0·28	0	9·8	82
Cape Town	1019·1	0·0	93	41	65·1	51·6	58·3	+ 0·4	53·3	84	6·9	2·24	0·00	15	..	..
Johannesburg	1015·5	— 0·3	88	25	72·5	48·2	60·3	+ 0·9	45·1	31	1·5	0·42	— 0·54	1	10·4	87
Mauritius	1018·9	— 1·3	81	57	78·3	62·8	70·5	+ 0·4	66·6	66	5·3	2·28	+ 0·98	10	8·9	74
Calcutta, Alipore Obsy.	1005·0	+ 0·5	94	75	89·7	79·3	84·5	+ 1·3	80·2	92	7·0	12·66	+ 2·65	15*	..	..
Bombay	1007·1	— 0·9	89	73	86·5	76·8	81·7	+ 0·8	76·3	83	7·6	4·48	— 6·20	5*	..	..
Madras	1005·6	— 0·9	99	75	91·7	77·6	84·7	— 0·5	75·8	74	6·3	8·53	+ 3·68	8*	..	..
Colombo, Ceylon	1009·9	0·0	86	73	84·4	76·8	80·6	— 0·6	77·1	79	7·3	5·54	+ 0·78	17	6·9	57
Singapore	1009·3	— 0·5	91	70	87·4	74·9	81·1	— 0·1	77·6	83	7·7	9·79	+ 3·02	21	5·4	44
Hongkong	1008·2	— 0·2	91	65	85·8	77·5	81·7	+ 0·7	76·9	77	6·8	13·43	+ 3·71	20	6·2	51
Sandakan	..	..	91	73	88·0	74·8	81·4	— 0·3	77·5	83	..	4·28	— 5·05	12	..	..
Sydney, N.S.W.	1014·1	— 2·0	90	42	68·5	50·9	59·7	+ 0·5	54·6	64	5·1	4·95	+ 2·09	8	7·1	60
Melbourne	1012·8	— 3·0	78	34	63·4	44·4	53·9	— 0·2	49·2	69	6·6	2·03	— 0·41	16	5·8	49
Adelaide	1014·2	— 3·3	81	41	65·7	48·1	56·9	— 0·2	51·8	63	6·4	2·79	+ 0·74	16	6·4	54
Perth, W. Australia	1017·2	— 0·8	70	41	63·8	50·5	57·1	— 1·1	53·2	69	7·6	5·27	+ 1·85	21	5·5	47
Coolgardie	1015·7	— 1·4	93	36	71·5	44·5	58·0	— 0·7	49·5	49	2·8	0·33	— 0·34	2	..	..
Brisbane	1016·7	— 0·9	86	45	76·2	55·5	65·9	+ 0·7	58·7	60	3·2	0·91	— 1·14	7	8·5	72
Hobart, Tasmania	1005·5	— 5·5	77	35	58·4	42·1	50·3	— 0·7	44·3	60	6·3	1·77	— 0·30	21	6·0	51
Wellington, N.Z.	1010·0	— 4·6	65	33	52·5	41·8	47·1	— 4·5	45·4	80	7·9	3·79	— 0·18	21	4·3	36
Suva, Fiji	1014·5	+ 0·2	84	67	79·3	70·2	74·7	+ 0·2	71·0	80	7·4	7·34	— 0·35	15	3·8	32
Apia, Samoa	1011·8	— 0·4	88	68	85·3	73·2	79·2	+ 1·0	76·4	77	5·5	5·47	+ 0·36	16	7·2	60
Kingston, Jamaica	1011·5	— 0·7	91	70	87·5	73·3	80·4	— 1·1	73·0	88	7·7	3·34	— 0·69	12	6·0	49
Grenada, W.I.	1013·1	+ 1·3	91	72	87·9	74·6	81·3	+ 1·0	74·6	76	4·5	12·97	+ 4·98	24	..	..
Toronto	1015·2	— 2·6	96	42	75·4	56·4	65·9	+ 5·6	58·7	82	4·9	2·18	— 0·49	12	7·0	56
Winnipeg	1010·9	— 2·9	96	33	70·3	49·6	59·9	+ 6·2	49·4	89	5·1	3·23	+ 1·01	12	6·6	52
St. John, N.B.	1013·9	— 3·5	71	40	62·3	49·6	55·9	0·0	52·1	83	5·9	5·18	+ 1·44	18	4·7	37

*For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.

Kingston, Jamaica ..	1011·5	— 0·7	91	70	87·5	73·3	80·4	— 1·1	73·0	88	7·7	3·34	— 0·69	12	6·9	49
Grenada, W.I.	1013·1	+ 1·3	91	72	87·9	74·6	81·3	+ 1·0	74·6	76	4·5	12·97	+ 4·98	24	..	..
Toronto	1015·2	— 2·6	96	42	75·4	56·4	65·9	+ 5·6	58·7	82	4·9	2·18	— 0·49	12	7·0	56
Winnipeg	1010·9	— 2·9	96	33	70·3	49·6	59·9	+ 6·2	49·4	89	5·1	3·23	+ 1·01	12	6·6	52
St. John, N.B.	1013·9	— 3·5	71	40	62·3	49·6	55·9	0·0	52·1	83	5·9	5·18	+ 1·44	18	4·7	37
Victoria, B.C.	1015·4	— 1·0	69	46	61·0	50·5	55·7	— 0·4	53·6	90	5·9	2·28	+ 0·47	15	5·4	..

fallen.